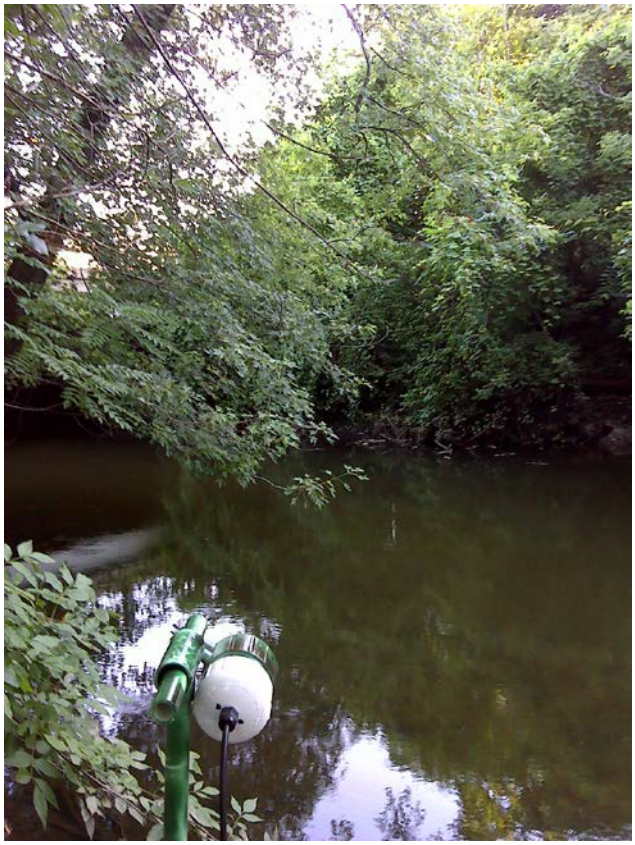
Environmental Consulting & Technology, Inc.

Indiana Bat Monitoring Survey

For

Portage Creek Sediment Remediation Project
Kalamazoo, Michigan



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OVERVIEW

Environmental Consulting & Technology (ECT) in conjunction with North East Ecological Services (NEES) conducted acoustic monitoring at the Portage Creek remediation site, located at the confluence of the Kalamazoo River. The acoustic sampling conducted was consistent with the USFWS Indiana Bat survey guidelines in all respects, including the seasonal timing (May 15 – August 15) and the use of a qualified surveyor (Dr. Scott Reynolds). The sampling effort also well-exceeded the minimum sampling effort that is considered adequate to document the presence of Indiana myotis and used an approved and peer-reviewed methodology to both collect and analyze the acoustic data. Specifically, NEES utilized fifteen (15) detector-nights of monitoring within the project area over a three-night period of time. The detectors were distributed across ten (10) sampling locations that were chosen based on roost habitat (presence of snags or large emergent canopy trees) or foraging habitat (field edge, water edge, and riparian corridors) that could be used to acoustically capture Indiana myotis (*Myotis sodalis*) that were using the project area.

Analysis of the call files revealed a bat community dominated by big brown bats (*Eptesicus fuscus*) with relatively few calls documented from the genus Myotis. Although preliminary analysis of the calls from Site 10 suggested the presence of Indiana myotis, more detailed analysis using the latest version of EchoClass (v2.0) determined no evidence of Indiana myotis using the Maximum Likelihood crierion and that these calls were more likely to be big brown bats. Consequently, completion of the proposed tree removal and grubbing activities during the remainder of the summer and fall season could proceed without posing a direct impact to Indiana myotis.

INTRODUCTION

The Portage Creek Sediment Remediation Project site ('Project Site'), specifically the section at Slope Area 1A (SA1A), requires additional pre-dredging construction work, including tree clearing and grubbing, in order to begin dredging in mid-September through October 2013. The project required a desktop and field-based habitat assessment to determine the presence of suitable habitat at the Project Site and an acoustic monitoring survey to document the presence of the federally-endangered Indiana myotis (*Myotis sodalis*). The SA1A Project Site is consists of a 450 ft (0.14 km) section of the Portage Creek that extends from the current dredging operations north to East Michigan Avenue and a 200 ft (0.06 km) section of the Portage Creek that extends from East Michigan Avenue north to the confluence of the Kalamazoo River.

The Indiana myotis was first documented in Michigan in 1865 (U.S. National Museum #5505), yet only ten individuals were captured in the state prior to 1979 (Kurta et al., 1993). In 1979, ten Indiana myotis were captured along Lacey Creek in Eaton County Michigan, approximately 39 miles (63 km) northeast of Kalamazoo (Kurta et al, 1993). Since then, Indiana myotis have been documented summering in several counties in the southern Lower Peninsula (MDNR, 2005), with the only known hibernaculum in the state found at the Tippy Dam hydroelectric facility in Manistee County 135 miles (218 km) north of the Project Site (Kurta and Rice, 2002; King, 2011). Indiana myotis are generally perceived as riparian habitat specialists due to the extensive summer surveys of this species in their core region (Midwest: Ford et al., 2005; Timpone et al., 2010). However, a broader view of habitat surveys across their range suggests that upland forest habitat is also critical for this species (Scherer, 1999). In the northern region of their range, including Michigan, it appears that Indiana myotis are much less specialized in riparian habitats and more often found associated with old-field, pasture habitat, and forested wetland habitat ((Kurta et al. 1993; Kurta, 2001; Kurta et al., 2002; Kurta, 2005; Winhold et al., 2005). A survey of three riparian habitats (Thornapple, Looking Glass and Maple Rivers) of southern Michigan failed to document any Indiana myotis (Brack et al., 1984). Indiana myotis in Michigan have primarily been documented roosting under the loose bark of dead or dying trees (Kurta and Rice, 2002). In contrast, Indiana myotis were found exclusively in agricultural and rural habitat along the River Raisin near Norvell, MI (Murray and Kurta, 2004).

Across their range, Indiana myotis have been shown to be highly flexible in the species composition of roost trees, although almost all roost trees are deciduous (USFWS, 2007; Kitchell, 2008). Most Indiana myotis roost trees, with the exception of shagbark hickory (*Carya ovata*), are typically dead or dying (Kurta et al., 2002; Kurta, 2005), often with at least 25% of their bark surface exfoliating (Garner and Gardner, 1992). Living trees, when utilized as maternity roosts, are primarily alternative roosts that are used infrequently and for smaller numbers of bats than primary roost tree (Kurta, 2005). Most Indiana myotis roost tree surveys have found that roost trees are larger and taller than random trees in their proximity. Although the current Indiana myotis survey guidelines suggest trees as small as 12 cm dbh can be potential roost trees (USFWS, 2013), most studies, including a large meta-analysis of 27 published papers from 12 states, have found that roost trees are greater than 36 cm dbh (Kurta et al., 1993; Kurta and Rice, 2002; Kurta et al., 2002; Kitchell, 2008) and at least 18 m tall (Kurta et al., 1993). These roost trees are often found with intermediate levels of canopy closure (67%-83%: Kitchell, 2008), resulting in high insolation that provides at least 10 hours of direct sunlight (Kurta and

Rice 2002; Kurta et al. 2002). Typical maternity roost habitat has a roost tree density of at least 13.2 snags per hectare (Carter, 2005), although Clawson et al. (2000) suggests riparian habitats should contain at least 29 snags per hectare.

The Portage Creek project site in Kalamazoo is a highly developed landscape. Indiana myotis have been documented foraging or roosting in suburban and semi-urban habitat, including roosting in a large maple (*Acer spp.*) tree outside of Cincinatti, Ohio (Belwood, 2002) and in a cottonwood (*Populus deltoides*) snag 140 m from a highway in Indiana(Hendricks et al., 2005). There has also been extensive monitoring of Indiana myotis adjacent to the Indianapolis Airport in Indiana (Sparks et al., 2005). Despite these observations, landscape-level analyses of habitat preferences suggest that Indiana myotis typically avoid developed habitat (Brack, 2006) and prefer woodland habitat for both foraging and commuting relative to residential, commercial, or park habitat (Sparks et al., 2005). At the Indianapolis Airport cited above, the presence of Indiana myotis was driven by the fact that the adjacent habitat was primarily agricultural and woodland habitat with less than 3% of the land in urban or park habitat (Sparks et al., 2005).

HABITAT ASSESSMENT

Prior to commencing field work, a desktop habitat assessment was conducted using publically-available aerial photographs (Google Earth) and information provided by Environmental Quality Management, Inc. ('EQM'). ECT and NEES conducted an on-site habitat assessment on 17 July through 19 July, 2013 concurrent with the acoustic monitoring. The entire project site was searched in order to characterize the riparian buffer and to identify potential acoustic monitoring sample sites. The riparian buffer south of East Michigan Avenue was a mixed deciduous stand of young trees with a low density of emergent canopy trees and three completely exfoliated snags. The understory was extremely dense and dominated by shrubs and short trees, including the common sumac (*Rhus glabra*) and Japanese knotweed (*Fallopia japonica*). The riparian buffer was extremely narrow (< 5 m) and generally consisted of a row of single trees (mostly silver maple (*Acer saccharum*) on either side of the creek with the associated shrubs and understory. On the western bank of the Portage Creek, the vegetation was constrained by commercial building lots for the entire length of the creek. On the eastern bank, the riparian buffer was constrained by a paved parking lot in the southern end and an open field habitat at the northern end up to the intersection with East Michigan Avenue.

On the northern project area, the riparian buffer was more extensive, better developed, and of older age than the southern project area. Although there remained a relatively thin riparian buffer and a dense understory along the western edge of the creek and adjacent to the commercial lots, the northern section of the project area generally had more mature trees with a better developed canopy. On the eastern side of Portage Creek, adjacent to Veteran's Memorial Park, there were more ornamental hardwoods near the park, including American basswood (*Tilia Americana*), bur oak (*Quercus macrocarpa*), honeylocust (*Gleditsia triacanthos*) and silver maple (*Acer saccharum*). Along the creek bank extending to the confluence of the Kalamazoo River, there were several white ash (*Fraxinus americana*), silver maple (*A. saccharum*), and American beech (*Fagus grandifolia*) trees extending out over the water. These trees were generally larger (> 20 cm dbh) and appeared to be healthy with no visible bark exfoliation.

METHODOLOGY

To help document the population of bats utilizing the Portage Creek Remediation site, we utilized a study protocol consistent with the Range-Wide Indiana Bat Summer Survey Guidelines produced by the U.S. Fish and Wildlife Service (USFWS, 2013). Based on the information provided by EQM, the Portage Creek Remediation project site contains less than 123 acres of potential bat habitat, which would entail a minimum sampling effort of six detector-nights. However, ECT chose to sample at a higher rate in order to focus on both potential roost trees (large exposed snags) as well as the foraging habitat. All sampling points were documented from the perspective of the microphone using a Garmin Oregon 550T GPS system that generated geo-referenced photographs and site characteristics and sampling conditions were recorded on site-specific field data sheets.

The survey utilized Titley ™ ultrasonic acoustic monitors (both Anabat II and Anabat SD1 units) with a detached microphone and self-contained power and data recording system. The Anabat systems were programmed to operate overnight (1800 – 0800) for fourteen hours, with microphones facing the target habitat or roosting feature. Each system was deployed in the field in a weather-tight housing with the microphone (pre-amplified Titley™ HI-MIC) set up at 1.5m above the ground and facing either parallel to the ground (habitat-based sampling points) or at 45° to ground (roost-tree sampling points). Each Anabat monitor was programmed with the following system settings: Sensitivity = 6, Audio DIV = 16, Data DIV = 16). Using these settings and sampling conditions, the microphone samples the air space near the ground or water surface (roughly up to 15 m above ground) with a potential sampling volume of 254m^3 (Larson & Hayes, 2000).

The microphones were connected to the Anabat systems using a 10 m shielded Canare Starquad™ video cable with an integrated signal amplifier (EME Systems, Berkely, California). All calls were collected from each recording system, filtered for noise, and analyzed for species and phonic-group identification using EchoClass 1.1 (Britzke, 2012) as a first-pass diagnostic tool. Because of high overlap of call characteristics, big brown bats (*Eptesicus fuscus*) and silver-haired bats (*Lasionycteris noctivagans*) were combined into one phonic group (BB-SH) as were all the bats within the genus *Myotis* (Myotis). For any site that had a positive indication for Indiana myotis, additional analysis was conducted using EchoClass 2.0 (Britzke, 2013). Each phonic group was considered a single species in terms of the presentation of results. A species was considered documented at the sample site if analysis of the call file determined a likelihood of presence ($p < 0.05$) based on the Maximum Likelihood criteria used in EchoClass 1.1.

All Anabat systems (Anabat II ultrasonic detectors: Titley Electronics) were bench-calibrated prior to use in the field to confirm time-activation, data collection, and data storage using a fixed-intensity ultrasonic signal located 6.5 m from the calibration microphone. All data cables were bench-calibrated using the same apparatus to confirm signal integrity. The microphones were bench-calibrated before field deployment and after completion of the project using a Binary Acoustics AT-100 multifrequency tonal emitter (BAT, Las Vegas, Nevada) to confirm minimum performance standards for six different ultrasonic frequencies (20kHz, 30kHz, 40kHz, 50kHz, 60kHz, and 70kHz). In addition, a minimum cone of receptivity (15° off-center) was verified by

rotating the microphone horizontally on a platform using the AT-100 as a sound source (Appendix III).

The desktop habitat analysis, on-site habitat survey, acoustic monitoring sample selection, acoustic system maintenance and calibration, data downloading, and acoustic analysis were all conducted by Dr. D. Scott Reynolds.

RESULTS

Data was collected from ten (10) sampling locations within the designated project area (Figure 1). Ten sites were sampled on July 17. The weather (detailed on the field data sheets, Appendix II) on July 17 was warm (T_{min} = 74°F) and humid (71%), with clear skies, low wind (Beauford Scale = 1) and a waxing gibbous (~ 60% illuminated) moon phase.

Five sites were re-sampled on July 19 to either confirm operation of the system (due to the lack of calls collected on the first sample night) or to re-sample habitats that suggested the presence of Indiana myotis during the first sampling period. The weather on July 19 was also warm (T_{min} = 70°F) and humid (87%), and included higher wind speeds and a short but powerful thunderstorm at approximately 00:30. At sunset, the weather was predominantly clear skies, low wind (Beauford Scale = 1) and a waxing gibbous (~ 80% illuminated) moon phase.

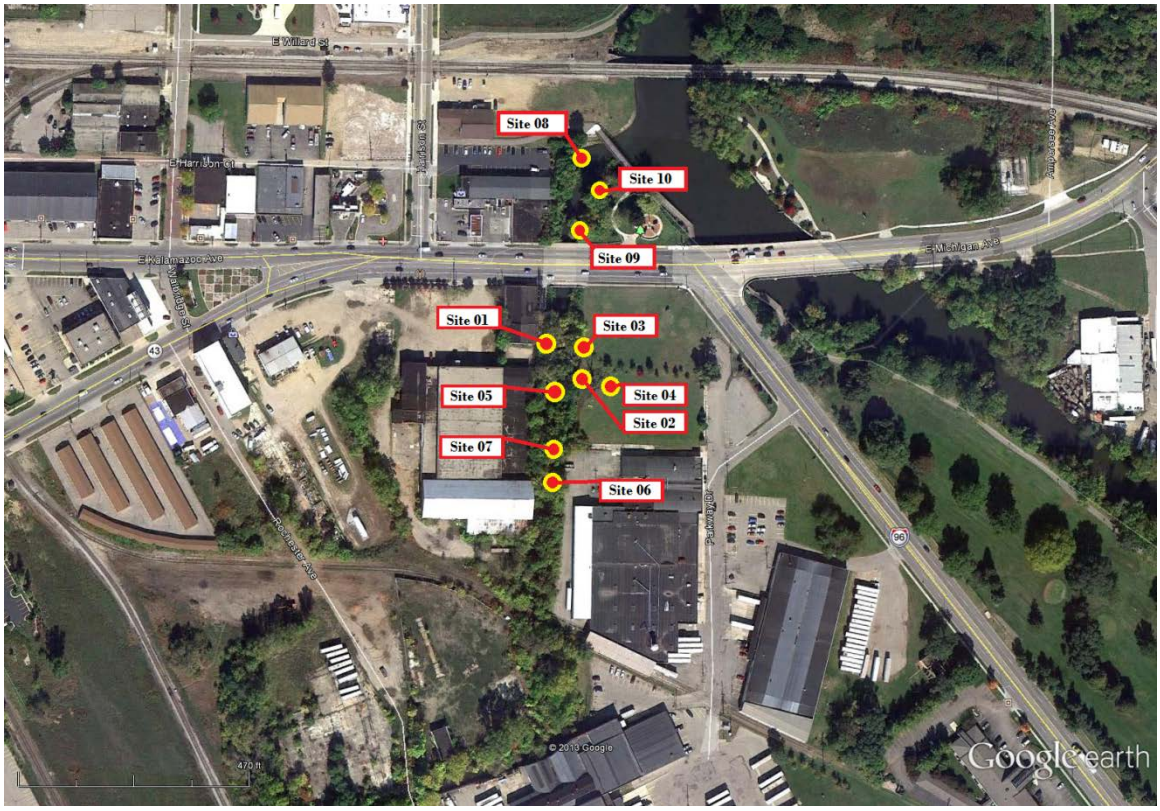


Figure 01: Aerial Photo of Project Site with Sampling Locations

Several of the initially planned sampling locations outside of the Project Site were not utilized due to the public access in those areas and the lack of security that could ensure the equipment would not be vandalized or stolen. There was also less monitoring on the western side of the Portage Creek due to the lack of physical space to sample between the riparian buffer and the commercial property adjacent to the impact area. In total, fifteen (15) detector-nights of monitoring occurred within the project area over a three-night period of time.

A total of 261 files recorded during the sampling period, yielding an overall bat activity level of 17.4 calls per detector-night (Table 1). The three potential roost trees had a lower overall bat activity rate than the habitat-based sampling points (9.6 calls/dn vs 21.3 calls/dn, respectively). A more detailed call summary is provided in Appendix IV.

Snag 01 (Site 4) had 12 potential bat calls, but half of them were unidentified call fragments suggesting that most of the recorded activity was occurring some distance from the tree. Four of the calls were identified as belonging to the Myotis phonic group, but all were classified as northern myotis (*Myotis septentrionalis*) and all were documented within a 60 second time period (01:04 – 01:05) suggesting a single individual bat was foraging within the vicinity of the tree. Snag 02 (Site 2 and Site 3) had 32 potential bat calls but the majority of them were unidentified call fragments. Only one potential Myotis call was identified (as little brown myotis, *Myotis lucifugus*) at 03:23 in the morning. The majority of identified calls belonged to the BB-SH phonic group and were most likely big brown bats (*E. fuscus*). Snag 03 had the lowest level of bat activity, with no documented Myotis calls. All together, none of these potential roost trees had the activity levels, species composition, or temporal timing (large numbers of calls near sunset and sunrise) to suggest that they were being utilized as tree roosts by bats.

Table 1: Preliminary Analysis of Acoustic Data Collected at Portage Creek Remediation Site

Site ID	Site Description [detector orientation]	GPS Location	Total Calls	Total Potential Species	Evidence of Indiana Bats
Site 1 [1]	Snag (Tree 03) located along Portage Creek [E]	42° 17.654'N 085° 34.421'W	3	2	no
Site 2 [1]	Snag (Tree 02) located along Portage Creek [W]	42° 17.644'N 085° 34.404'W	14	4	no
Site 3	Snag (Tree 02) and field edge along Portage Creek [S]	42° 17.653'N 085° 34.401'W	18	4	no
Site 4 [1]	Snag (Tree 01) located along Portage Creek [N]	42° 17.643'N 085° 34.399'W	13	3	no
Site 5	At he coffer dam location along Portage Creek [S]	42° 17.646'N 085° 34.413'W	18	3	no
Site 6	Along Portage Creek corridor towards active remediation activity [S]	42° 17.609'N 085° 34.413'W	19	4	no
Site 7	Along Portage Creek corridor away from the remediation activity[N]	42° 17.605'N 085° 34.413'W	48	4	no
Site 8	On riparian bank at Kalamazoo, facing up Portage Creek [S]	42° 17.723'N 085° 34.407'W	54	4	no
Site 9 [1]	On riparian bank of Portage Creek facing upstream [S]	42° 17.700'N 085° 34.403'W	8	4	no
Site 10 [1]	On riparian bank of Portage Creek facing downstream [N]	42° 17.708'N 085° 34.401'W	66	5	no [2]

1. *Sampled on two separate nights*
2. *Initial analysis with Echoclass v1.1 suggested the presence of Indiana myotis. Re-analysis of the data with EchoClass v 2.0 confirmed no evidence of Indiana myotis*

The sampling points above the coffer dam (Sites 5-7) had an overall activity level of 28.3 calls/dn, with 56% of the activity documented from Site 7. Site 5 (at the coffer dam) and Site 6 (towards remediation activity) were sampling directly at the Portage Creek surface and had relatively low levels of bat activity. Site 7 (facing north) was facing the southern edge of the proposed vegetation removal. Although this site had the highest level of bat activity of the three upstream locations, it was dominated by early morning 00:31 – 1:31) hoary bat (*Lasiurus cinereus*) activity that presumably was coming from the edge habitat and the illuminated parking lot immediately northeast of the microphone. No Myotis activity was confirmed at any of the sites above the coffer dam.

Sites 8 – 10 represented the northern-most sampling points during the current survey. All three sites were downstream from the existing remediation activity and closest to the confluence of the Kalamazoo River (Figure 1). Overall, these sites had a bat activity level of 25.6 calls/dn. Site 8 was the northern-most sampling point and documented bat activity near the Kalamazoo River at the widest point of the Portage Creek basin. Bat activity at this site was almost exclusively from the BB-SH phonic group, with almost all of the identified calls belonging to big brown bats. Only one call was predominantly Myotis, although Myotis call fragments were tentative identified in 24 of the files. The one documented Myotis based on the Maximum Likelihood criteria was a single northern myotis at 03:58. Sites 9 and 10 were sampling bat activity under the riparian canopy behind the Veteran's Park seating area. Site 9 was sampling upstream and had a low level of bat activity that was exclusively identified as big brown bat. Site 10 had 42 recorded calls during the first night of sampling, with the vast majority of calls identified as big brown bats. Three calls however (N7172258.52#, N7172322.51#, and N7180237.57#) were identified as Indiana myotis based on the Maximum Likelihood critera used in EchoClass v1.1. Sampling on the second night could not confirm these results, as all the identified calls were documented as big brown bats.

Due to the implications of these results, the data from Site 10 were re-analyzed using the latest release of EchoClass (v2.0) that has a more critical noise filter than the previous version. This analysis concludes that all three files initially identified as Indiana myotis were 'Unknown' based on the new filter criteria. In fact, the majority (88%) of call sequences that remained after filtering were categorized as 'Low' in frequency (characteristic of big brown bats) rather than 'High' (characteristic of Myotis).

DISCUSSION

The Portage Creek Sediment Remediation site is an EPA-driven contamination cleaning operation that is intended to remove chemical contamination along the Kalamazoo River. Given that chemical contamination of the environment is one of the suspected causes of decline for the Indiana myotis (Clawson et al., 2000), the long-term impact of this project should be highly favorable for the conservation of this species. However, the Michigan Department of Natural Resource Wildlife Action Plan clearly states that dredging and channelization of riparian corridors is problematic for Indiana myotis since this species prefers riparian forests (MDNR, 2005). Therefore the goal is to find a way to accomplish the remediation activity without negatively impacting the Indiana myotis. The Portage Creek project site has riparian vegetation characteristics and a stream width and water depth that has been documented as Indiana myotis habitat in some locations (Evans et al., 1998). However, ECT found no significant evidence that Indiana myotis were utilizing this project area as a foraging or roosting habitat.

None of the potential roost trees that were identified within the project impact area had the activity levels, species composition, or temporal timing (large numbers of calls near sunset and sunrise) to suggest that they were being utilized as tree roosts by bats of any species. There was evidence that one of the trees (Snag 01) was being utilized as a roost tree by birds (woodpecker holes and a twig nest) and a northern flicker (*Colaptes auratus*) was seen perching on the tree during the first night of sampling. Although there were several trees in the project area that met the definition of potentially suitable summer habitat (live trees greater than 5" dbh), they were all healthy with no evidence of bark exfoliation, were surrounded by thick understory vegetation, and had relatively low levels of insolation. The US Fish and Wildlife Service has decreased the size threshold for potential roost trees dramatically over the last several years, from 45 cm (18": USFWS, 2007) down to 33 cm (13": USFWS, 2012), to its current threshold of 12 cm (5"). This change reflects a better understanding of the diversity of roost trees Indiana myotis can use, and the increase awareness that many colonies use secondary roosts that are substantially smaller than their primary maternity roost (Kurta and Whitaker, 1998). However, roost tree analysis continues to show that trees under 36 cm dbh (14") are seldom used as primary maternity roosts, particularly in the northern region of the Indiana myotis range. Therefore it is unlikely that any of these trees are maternity roost sites for Indiana myotis and therefore could be removed during the summer breeding season without representing a direct impact to this species.

There was a low level of bat activity throughout the Portage Creek basin, although bat activity appeared to increase as one sampled closer to the confluence of the Kalamazoo River. It is unclear whether this low level of bat activity is due to the presence of better foraging habitat along the Kalamazoo River or the result of reduced habitat suitability caused by the existing remediation activity, either through water level reduction or pump noise. ECT sampled several of the higher activity sites a second night but failed to document the presence of Indiana myotis at the project site. A single night of sampling is generally adequate to document Indiana myotis in sites where they are known to be present. This is particularly true for sampling sites near water and has been confirmed for sampling sites in Michigan (Winhold and Kurta, 2008).

The call analysis suggests that the Portage Creek basin and adjacent area has a relatively low diversity of bat activity, with big brown bats (*Eptesicus fuscus*) dominating the documented

calls. There was a much higher potential diversity of bats based on the preliminary analysis but very few of the non-big brown bat call sequences or fragments met the Maximum Likelihood criteria to confirm presence. The dominance of big brown bats would be expected given the urban nature of the sampling environment. There were also several species of migratory tree bats tentatively documented at the project site, but only seven files were initially documented as belonging to the genus Myotis; four for the northern long-eared myotis (*M. septentrionalis*: Site 04) and three for the Indiana myotis (*M. sodalis*: Site 10). The calls tentatively identified as Indiana myotis calls from Site 10 are low-quality calls that are atypical of Indiana myotis calls. Specifically, the strongest portion of the call was well below the minimum frequency of Indiana myotis calls (Fmin = 40-41 kHz: Fenton and Bell, 1981; Thomas et al., 1987) and the high frequency piece of the call (> 60 kHz) was absent. The calls are more typical of big brown bats foraging in a cluttered environment; specifically, they showed an increase in frequency and reduced call interval relative to commuting calls from big brown bats in open areas (Rodriguez and Mora, 2006). This frequency and call interval shift makes the calls more similar to Myotis calls, but still are clearly distinguishable upon visual examination. Further analysis of these calls using EchoClass v2.0 supports this conclusion, with the calls re-interpreted as 'Unknown' but with a strong 'Low' frequency component more typical of big brown bats.

The EchoClass v1.1 software was designed to minimize the potential for false-negative results in regards to the presence of Indiana myotis, so it is extremely conservative in assigning calls to this species. Therefore, calls are often assigned to Indiana myotis when mist-netting data suggest other myotis species are emitting the calls. This software also frequently assigns Indiana myotis to calls in regions of the country that do not contain Indiana myotis. Given the lack of confirmation of Indiana myotis activity at the current project site using identification software approved by the U.S. Fish & Wildlife Service, we are confident that completion of the proposed tree removal and grubbing activities could proceed during the remainder of this summer breeding season and into the fall migratory season (August through November) without posing a direct impact on Indiana myotis.

LITERATURE CITED

Belwood, J.J. 2002. Endangered bats in suburbia: observations and concerns for the future Pp. 193-198. In: A. Kurta and J. Kennedy (eds.) The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International: Austin, Texas, USA.

Brack, V., S. Taylor, and V.R. Holmes. 1984. Bat captures and niche partitioning along portions of three rivers in southern Michigan. Michigan Academician, 16: 391-399.

Brack, V., Jr. 2006. Autumn activity of *Myotis sodalis* (Indiana bat) in Bland County, Virginia. Northeastern Naturalist, 13: 421-434.

Britzke, E.R., 2012. Instructions for using the EchoClass Acoustic ID Program, Version 1.1. << http://www.fws.gov/midwest/endangered/mammals/inba/downloads/ EchoClassV1-1instructions.pdf. >>

Britzke, E.R., 2013. Instructions for using the EchoClass Acoustic ID Program, Version 2. <<http://www.fws.gov/Midwest/Endangered/mammals/inba/downloads/2013/ Echoclass_v2_Instructions.pdf>>

Carter, T.C., 2005. Summer habitat assessment. Pp. 81-87 In: K.C. Vories and A. Harrington (eds) Proceedings of the Indiana bat & Coal Mining: A Technical Interactive Forum. Nov, 2004 U.S. Dept. Interior; Alton, IL.

Clawson, R.L.,V. Brack, R. Currie, M. Harvey, S. Johnson, A. Kurta, J. MacGregor, C. Stihler, M. Tuttle, G. Houf, and K. Tyrell, 2000. Indiana bat (*Myotis sodalis*) revised recovery plan.

Evans, D. E., W.A. Mitchell, and R.A. Fischer. 1998. Species profile: Indiana bat (Myotis sodalis) on military installations in the southerastern United States USACE Technical Report SERDP-98-3.

Fenton, M.B. and G.P. Bell, 1981. Recognition of species of insectivorous bats by their echolocation calls. *Journal of Mammalogy*, 62: 233-243.

Ford, W.M. M. Menzel, J.L. Rodrigue, J. Menzel, and J.B. Johnson, 2005. Relating bat species presence to simple habitat measures in a central Appalachian forest. Biological Conservation, 126: 528-539.

Garner, J.D. and J.E. Gardner, 1992. Determination of summer distribution and habitat utilization of the Indiana bat (*Myotis sodalis*) in Illinois: Final Report Project E-3 submitted to the Division of Natural Heritage, March 1992.

Hendricks, W.D., R. James, L. Alverson, J. Timpone, M. Muller, N. Nelson, J. Smelser. 2005. Notable roosts for the Indiana bat (*Myotis sodalis*). Pp. 133-138. In: K.C. Vories and A. Harrington (eds) Proceedings of Indiana Bat & Coal Mining: A Technical Interactive Forum. Nov, 2004 U.S. Dept. Interior; Alton, IL, USA.

King, R.A., 2011. Indiana bat population status and trends. Pp. 31-41 In K.C. Vories, A.H. Caswell, and T.M. Price (eds). Protecting Threatened Bats at Coal Mines: A Technical Interactive Forum. Southern Illinois University: Carbondale, Illinois.

Kitchell, M., 2008. Roost selection and landscape movements of female Indiana bats at the Great Swamp National Wildlife Refuge, New Jersey. Master's Thesis for William Paterson University.

Kurta, A., D. King, J.A. Teramino, J.M. Stribley, and K. Williams. 1993. Summer roosts of the endangered Indiana bat (*Myotis sodalis*) on the northern edge of its range. American Midland Naturalist, 129: 132-138.

Kurta, A. and J.O. Whitaker. 1998. Diet of the endangered Indiana bat (*Myotis sodalis*) on the northern edge of its range. American Midland Naturalist, 140: 280-286.

Kurta, A., 2001. The Indiana Bat: Biology and Management of an endangered species: Proceedings of a symposium in Lexington Kentucky. 50pp.

Kurta, A. and H. Rice, 2002. Ecology and management of the Indiana bat in Michigan. Michigan Academician, 34:175-190.

Kurta, A., and S. W. Murray. 2002. Philopatry and migration of banded Indiana bats (*Myotis sodalis*) and effects of radio transmitters. Journal of Mammalogy 83:585-589.

Kurta, A., S.W. Murray, and D.H. Miller. 2002. Roost selection and movements across the summer landscape. Pp. 118-129 *In*: A. Kurta and J. Kennedy (eds.) The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International: Austin, Texas.

Kurta, A., 2005. Roosting ecology and behavior of Indiana bats (Myotis sodalis) in summer. Pp. 29-42 In: K.C. Vories and A. Harrington (eds) Proceedings of the Indiana bat & Coal Mining: A Technical Interactive Forum. Nov, 2004 U.S. Dept. Interior; Alton, IL

Lacki, M.J. and D.R. Cox. 2009. Meta-analysis of summer roosting characteristics of two species of Myotis bats. American Midland Naturalist, 162: 318-326.

Larson, D.J. and J.P. Hayes, 2000. Variability in sensitivity of Anabat II bat detectors and a method of calibration. Acta Chiropterologica, 2: 209-213.

[MDNR] Michigan Department of Natural Resources, 2005. Wildlife Action Plan SGCN Status. <<http://www.michigan.gov/documents/dnr/mammals_326070_7.pdf>> Accessed 04 August, 2013.

Murray, S.W. and A. Kurta. 2004. Nocturnal activity of the endangered Indiana bat (*Myotis sodalis*). Journal of Zoology (London). 262: 197-206.

Rodriguez, A. and E. Mora. 2006. The echolocation repertoire of *Eptesicus fuscus* (Chiroptera: Vespertilionidae) in Cuba. Caribbean Journal of Science, 46: 121-128.

Scherer, A., 1999. A survey for the federally listed endangered Indiana bat (*Myotis sodalis*), Picatinny Arsenal, Morris County, New Jersey. Draft Report. U.S. Dept of the Interior, Fish and Wildlife Service, NJ Field Office.

Sparks, D.W., C.M. Ritzi, J.E. Duchamp, and J.O. Whitaker, Jr. 2005. Foraging habitat of the Indiana bat (*Myotis sodalis*) at an urban-rural interface. Journal of Mammalogy, 86: 713-718.

Thomas, D.W., G.P. Bell, and M.B. Fenton. 1987. Variation in echolocation call frequencies recorded from North American vespertilionid bats: a cautionary note. Journal of Mammalogy, 68: 842-847.

Timpone, J.C., J.G. Boyles, K. Murray, D. Aubrey, and L. Robbins. 2010. Overlap in roosting habits of Indiana bats (*Myotis sodalis*) and northern bats (*Myotis septentrionalis*). American Midland Naturalist 163: 115-123.

[USFWS] U.S. Fish and Wildlife Service. 2007. Indiana bat (*Myotis sodalis*). Draft Recovery Plan, First Revision. U.S. Fish and Wildlife Service. Fort Snelling, MN, 258 pp.

[USFWS] U.S. Fish and Wildlife Service. 2012. Rangewide Indiana bat summer survey guidance - DRAFT - February 03, 2012.

[USFWS] U.S. Fish and Wildlife Service. 2013. Range-wide Indiana bat summer survey guidelines- May 2013.

Winhold, L., E. Hough, and A. Kurta. 2005. Long-term fidelity by tree-roosting bats to a home area. Bat Research News, 46: 9-10.

Winhold, L. and A. Kurta. 2008. Netting surveys for bats in the Northeast: differences associated with habitat, duration of netting, and use of consecutive nights. Northeastern Naturalist 15: 263-274.

APPENDIX I - Site Photographs

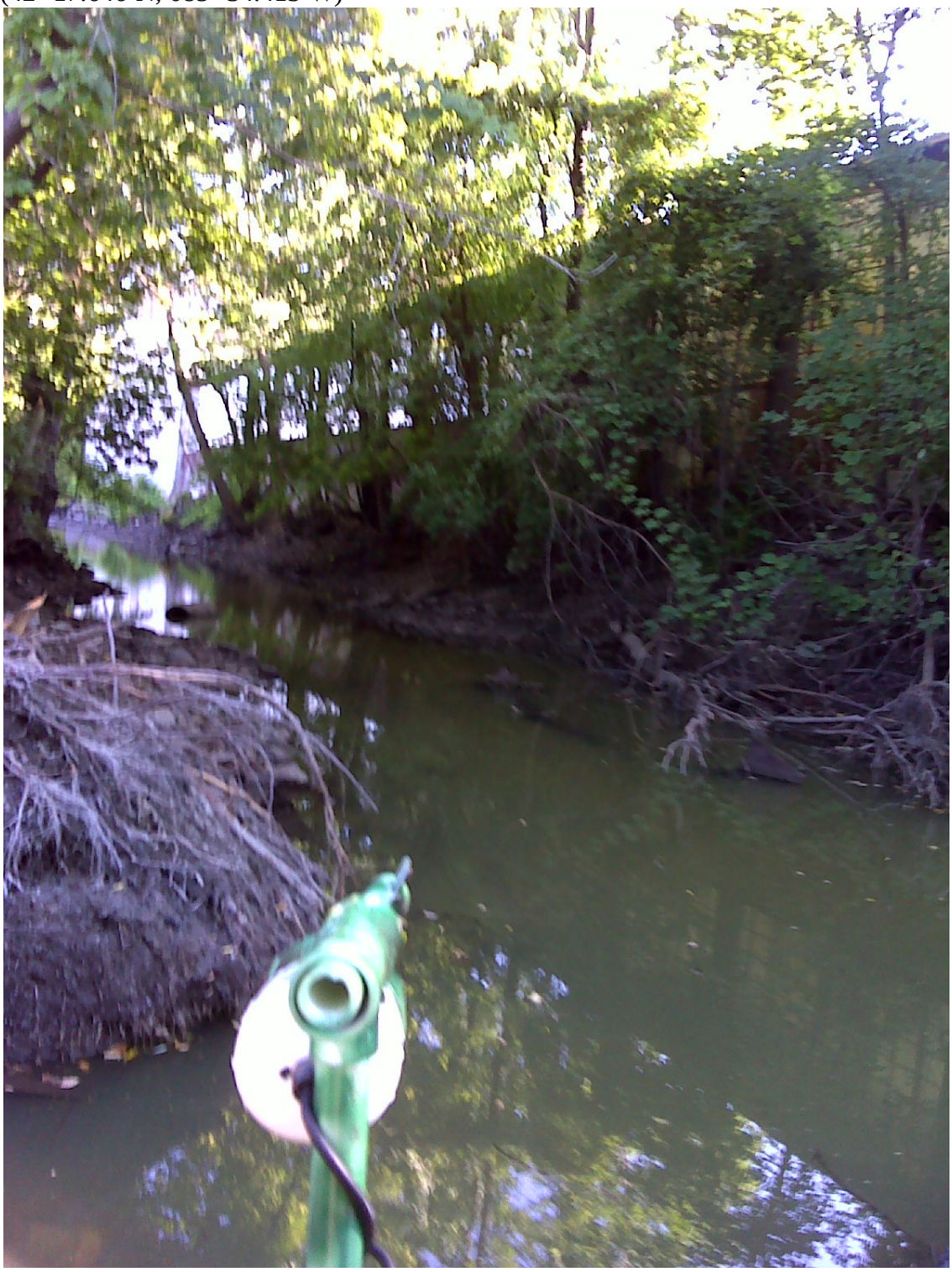
Site Photographs, 1 of 10
Site 01 – Snag ‘03’ located on western bank of Portage Creek with monitor facing East (42° 17.654’N, 085° 34.421’W)

Site Photographs, 2 of 10
Site 02 – Snag ’02’ located on eastern bank of Portage Creek with monitor facing North (42° 17.644’N, 085° 34.404’W)

Site Photographs, 3 of 10
Site 03 - Snag ’02’ located on eastern bank of Portage Creek with monitor facing SW (42° 17.653’N, 085° 34.401’W)

Site Photographs, 4 of 10
Site 04 – ‘Snag 01’ located on eastern bank of Portage Creek with monitor facing NW (42° 17.643’N, 085° 34.399’W)

Site Photographs, 5 of 10
Site 05 – Coffer Dam of Portage Creek with monitor facing South
(42° 17.646'N, 085° 34.413'W)

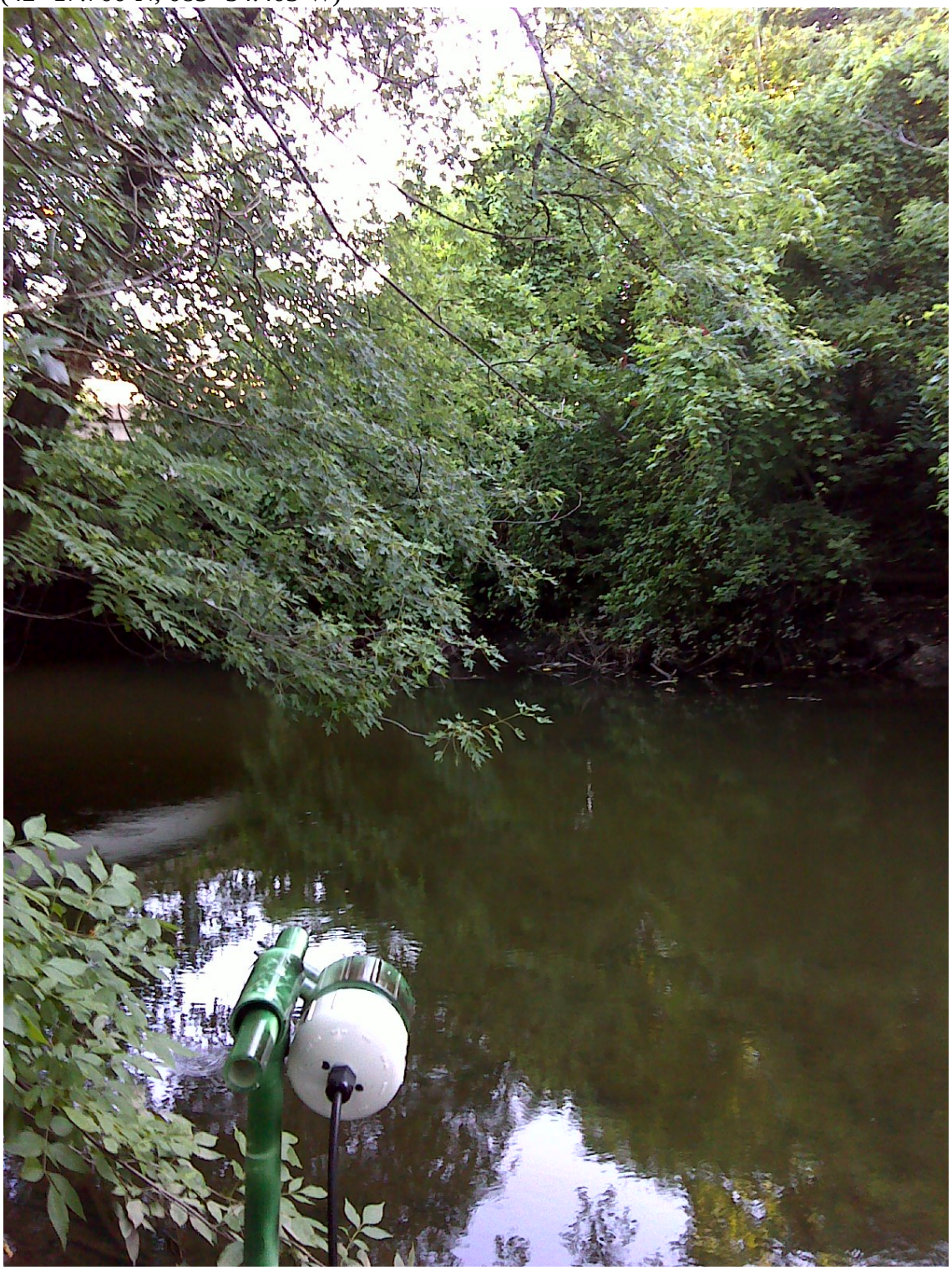


Site Photographs, 6 of 10
Site 06 – Upstream from Coffer Dam with monitor facing South
(42° 17.609'N, 085° 34.413'W)

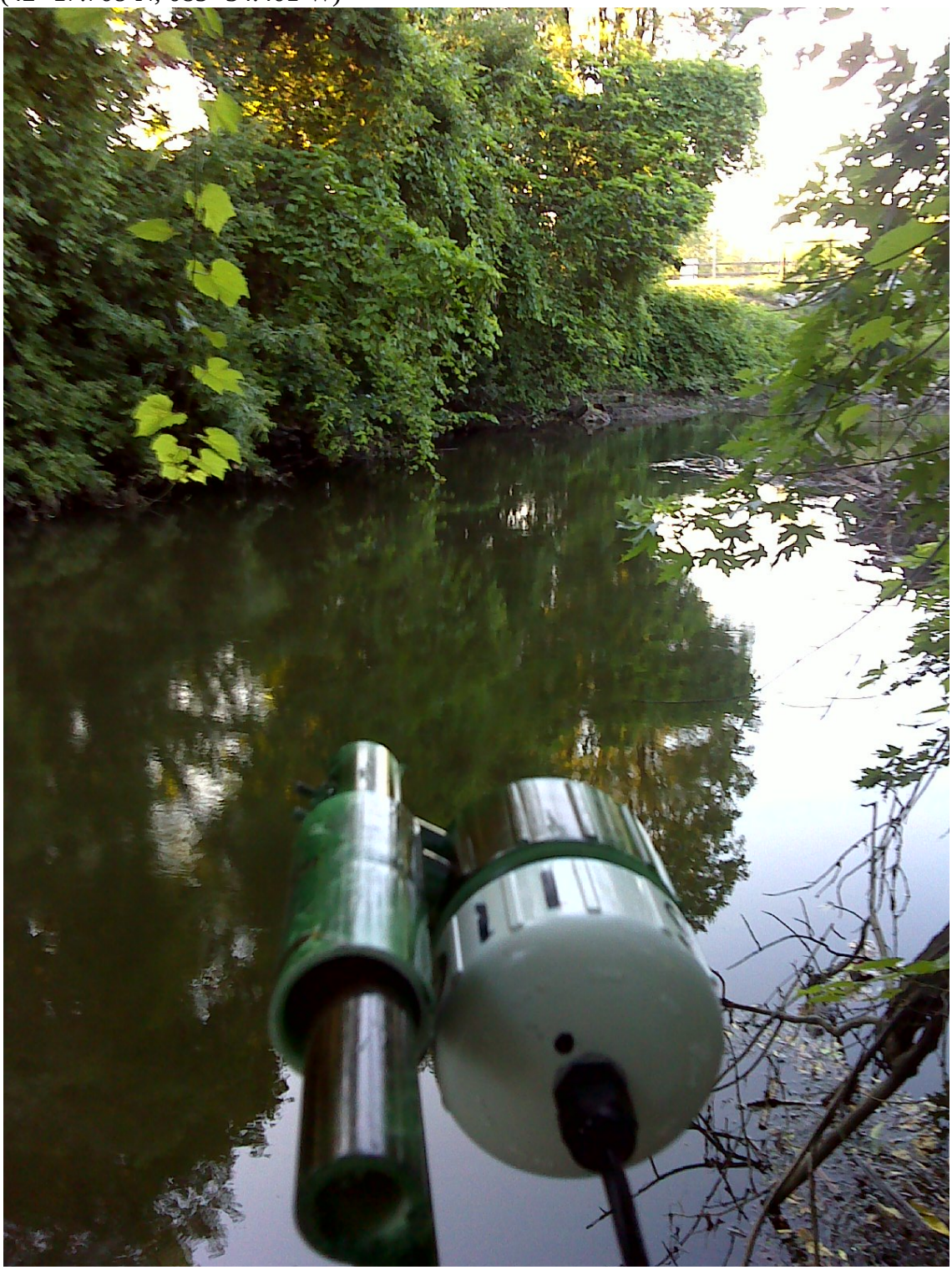
Site Photographs, 7 of 10
Site 07 – Upstream from Coffer Dam with monitor facing North
(42° 17.605’N, 085° 34.413’W)

Site Photographs, 8 of 10
Site 08 – Veteran's Park Footbridge on western bank of Portage Creek, facing South
(42° 17.723'N, 085° 34.407'W)

Site Photographs, 9 of 10
Site 09 – Behind Veteran's Park on eastern bank of Portage Creek, monitor facing SW
(42° 17.700'N, 085° 34.403'W)



Site Photographs, 10 of 10
Site 10 - Behind Veteran's Park on eastern bank of Portage Creek, monitor facing North (42° 17.708'N, 085° 34.401'W)



APPENDIX II - Field Data Sheets

Starting Date: 17 July 2013
Total Sample Nights: 1

Project Name: PORTAGE CREEK Project: Pg 1 of 9
Site Name:

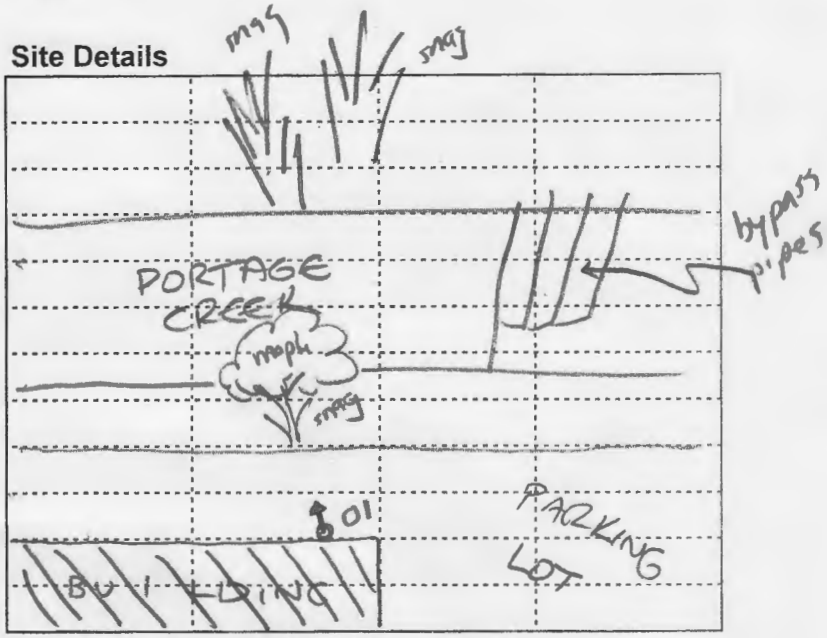
Weather: 07/17/13

start time: 18:00 moon: 1/2+
end time: 08:00 Sky: 0
Wind: 1
weather: hot and humid conditions
setup at 18:15

Weather: __/__/____

start time: moon:
end time: Sky:
Wind:
weather:

Site Details



Dominant Vegetation:

1 sugar maple 3 scrub
2 sumac 4

01 ANABAT Details: 07/17/13

Anabat # 0401 0403	GPS
Battery # 56	lat: 42° 17.857N
Microphone # 86	long: 085° 41.089W
Cable # 112	PHOTO 07 DSC00163
CARD # 70	Box 24

Sampling Habitat	Total Calls	Total Species
on gravel road facing exfoliating snag and large maple	0	0

ANABAT Details: __/__/____

Anabat #	GPS
Battery #	lat:
Microphone #	long:
Cable #	
CARD #	

Sampling Habitat	Total Calls	Total Species

Sky Code	
0	clear
1	scattered clouds
2	cloudy or overcast
3	fog or drizzle
4	sustained rain

Beauford Wind Scale
0 calm (0 mph)
1 light wind (1-3 mph)
2 light breeze (4-7 mph)
3 gentle breeze (8-12 mph)
4 moderate breeze (13-18 mph)

Starting Date: 17 JULY 2013
Total Sample Nights: 1

Project Name: PORTAGE CREEK Project: Pg 2 of 9
Site Name:

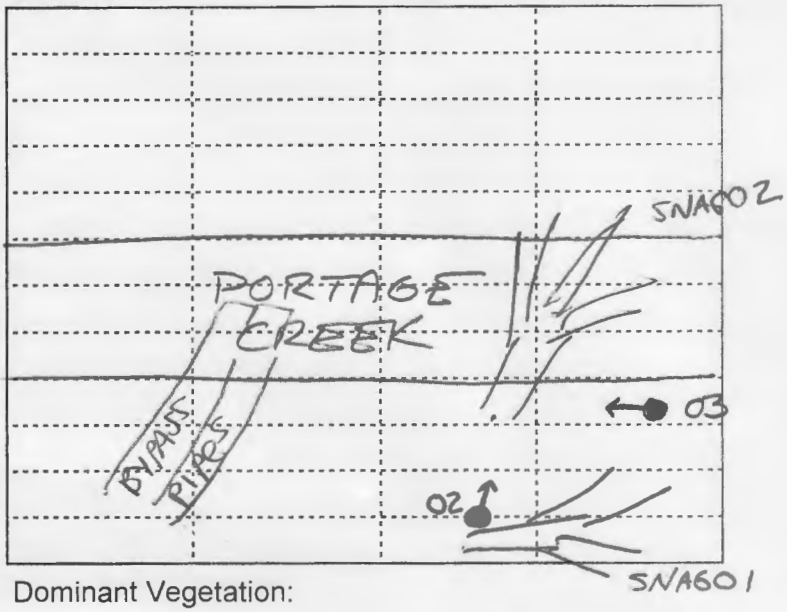
Weather: 17/07/13

start time: 18:00 moon: 1/2 T
end time: 08:00 Sky: 0
Wind: 1
weather: hot and humid
~90°F
set up at 18:30

Weather: __/__/__

start time: moon:
end time: Sky:
Wind:
weather:

Site Details



Dominant Vegetation:
1 _____ 3 _____
2 _____ 4 _____

✓02 ANABAT Details: 07/17/13

Anabat # 0416 0417	GPS
Battery # 55	lat: 42° 17.642 N
Microphone # 95	long: 085° 34.401 W
Cable # 110	PHOTO DSC 00165
CARD # 110	~~BOX 29~~

Sampling Habitat	Total Calls	Total Species
pointing at snag 02 under snag 01	25	4

✓03 ANABAT Details: __/__/__

Anabat # 0424 0427	GPS
Battery # 45	lat: 42° 17.652 N
Microphone # 44	long: 085° 34.401 W
Cable # 114	PHOTO DSC 00164
CARD # 107	BOX 14

Sampling Habitat	Total Calls	Total Species
pointing at snag 02 on field edge	47	4

Sky Code	
0	clear
1	scattered clouds
2	cloudy or overcast
3	fog or drizzle
4	sustained rain

Beauford Wind Scale
0 calm (0 mph)
1 light wind (1-3 mph)
2 light breeze (4-7 mph)
3 gentle breeze (8-12 mph)
4 moderate breeze (13-18 mph)

Starting Date: 17 JULY 2013
Total Sample Nights: 1

Project Name: PORTAGE CREEK Project: Pg 3 of 9
Site Name:

Weather: 17/07/2013

start time: 18:00 moon: ½+
end time: 08:00 Sky: 0
Wind: 1

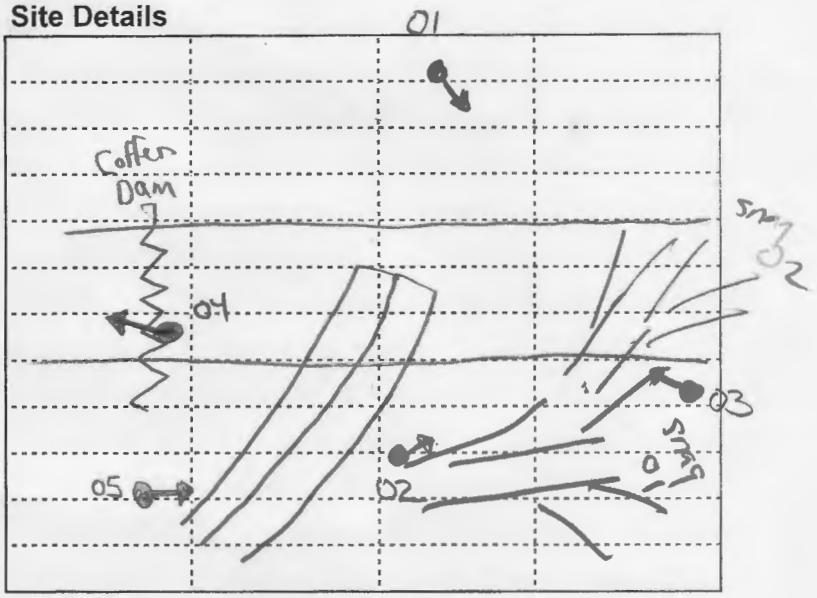
weather:
hot and humid conditions
setup at 18:30

Weather: / /

start time: moon:
end time: Sky:
Wind:

weather:

Site Details



Dominant Vegetation:

1 _____ 3 _____
2 _____ 4 _____

04 ANABAT Details: 07/17/13

Anabat #	0414 0415	GPS
Battery #	46	lat: 42° 17.646' N
Microphone #	87	long: 085° 34.418 W
Cable #	54	PHOTO DSC 00177
CARD #	04	~~BOX 27~~

Sampling Habitat	Total Calls	Total Species
sampling at Coffer dam up Portage Creek	13	3

05 ANABAT Details: / /

Anabat #	0429 0428	GPS
Battery #	58	lat: 42° 17.641 N
Microphone #	52	long: 085° 34.408 W
Cable #	45	PHOTO DSC 00178
CARD #	69	BOX 13

Sampling Habitat	Total Calls	Total Species
sampling snag 01	27	3

Sky Code	
0	clear
1	scattered clouds
2	cloudy or overcast
3	fog or drizzle
4	sustained rain

Beauford Wind Scale
0 calm (0 mph)
1 light wind (1-3 mph)
2 light breeze (4-7 mph)
3 gentle breeze (8-12 mph)
4 moderate breeze (13-18 mph)

Starting Date: 17 JULY 2013
Total Sample Nights: 1

Project Name: PORTAGE CREEK Project: Pg 4 of 9
Site Name:

Weather: 17/07/2013

start time: 18:00 moon: 1/2+
end time: 06:00 Sky: 0
Wind: 1

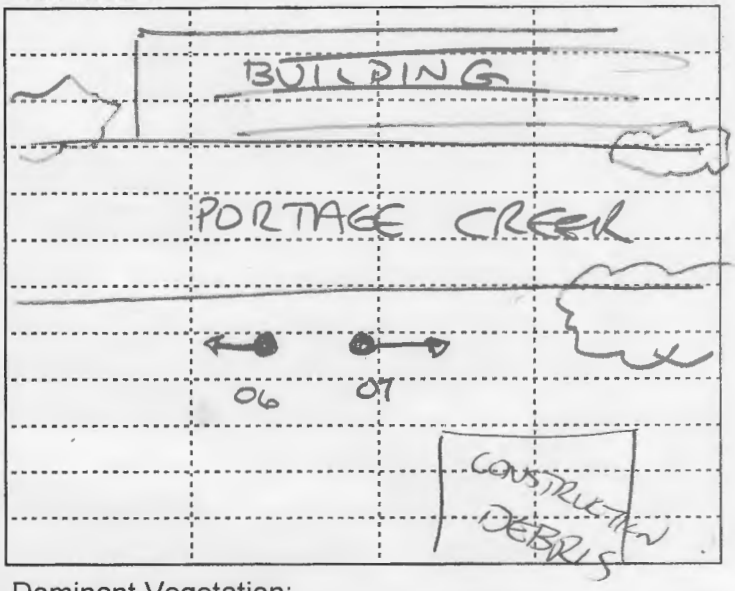
weather:
hot and humid
setup at 19:00

Weather: __/__/____

start time: moon:
end time: Sky:
Wind:

weather:

Site Details



Dominant Vegetation:

1 _____ 3 _____
2 _____ 4 _____

✓06 ANABAT Details: 07/17/13

Anabat # 0418 0419	GPS
Battery # 52	lat: 42°17.605N
Microphone # 76	long: 085°34.413W
Cable # 111	PHOTO
CARD # 33	BOX 12

Sampling Habitat	Total Calls	Total Species
elevated bank looking up Portage Creek no vegetation	22	4

✓07 ANABAT Details: __/__/____

Anabat # 0421 0425	GPS
Battery # 59	lat: 42°17.605N
Microphone # NAI 03	long: 085°34.413W
Cable # 113	PHOTO
CARD # 67	BOX 26

Sampling Habitat	Total Calls	Total Species
elevated bank looking down Portage Creek no vegetation	54	4

Sky Code	
0	clear
1	scattered clouds
2	cloudy or overcast
3	fog or drizzle
4	sustained rain

Beauford Wind Scale
0 calm (0 mph)
1 light wind (1-3 mph)
2 light breeze (4-7 mph)
3 gentle breeze (8-12 mph)
4 moderate breeze (13-18 mph)

Starting Date: 17 JULY 2013
Total Sample Nights: 1

Project Name: PORTAGE CREEK Project: Pg 5 of 9
Site Name:

Weather: 17/07/2013

start time: 18:00 moon: 1/2+
end time: 06:00 Sky: 0
Wind: 1

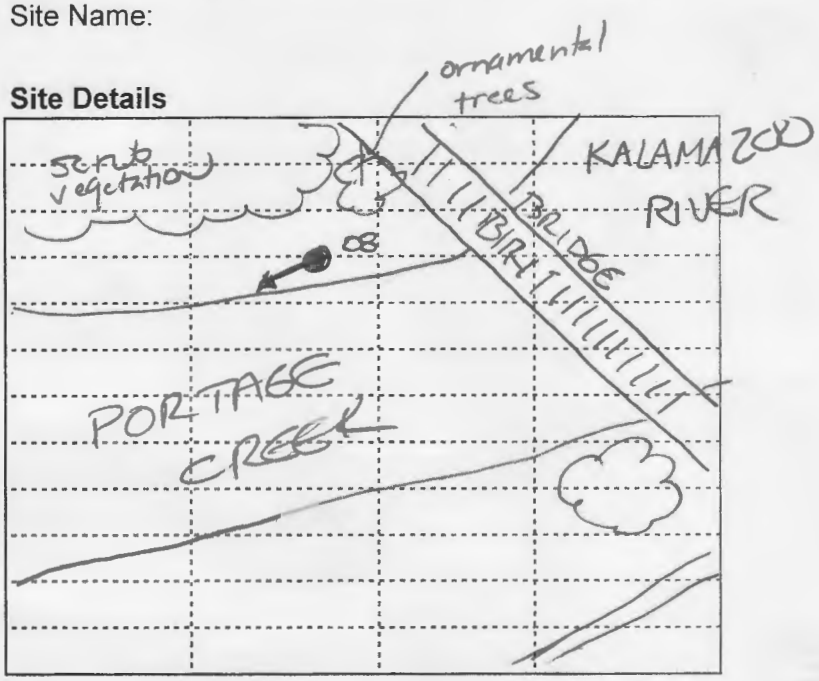
weather:
hot and humid conditions
set up at 19:30

Weather: __/__/____

start time: moon:
end time: Sky:
Wind:

weather:

Site Details



Dominant Vegetation:

1 _____ 3 _____
2 _____ 4 _____

✓08 ANABAT Details: 17/07/2013

Anabat # 0433 0432	GPS
Battery # 54	lat: 42°17.723 N
Microphone # 97	long: 085°34.407W
Cable # 115	PHOTO DSC 00183
CARD # 94	BOX 25

Sampling Habitat	Total Calls	Total Species
muddy bank at water level near Veterans Park footbridge pointing up Portage Creek	60	4

ANABAT Details: __/__/____

Anabat #	GPS
Battery #	lat:
Microphone #	long:
Cable #	
CARD #	

Sampling Habitat	Total Calls	Total Species

Sky Code	
0	clear
1	scattered clouds
2	cloudy or overcast
3	fog or drizzle
4	sustained rain

Beauford Wind Scale
0 calm (0 mph)
1 light wind (1-3 mph)
2 light breeze (4-7 mph)
3 gentle breeze (8-12 mph)
4 moderate breeze (13-18 mph)

Starting Date: 17 JULY 2013
Total Sample Nights: 1

Project Name: PORTAGE CREEK Project: Pg 6 of 9
Site Name:

Weather: 17/07/2013

start time: 18:00 moon: ½+
end time: 0806 Sky: 0
Wind: 1

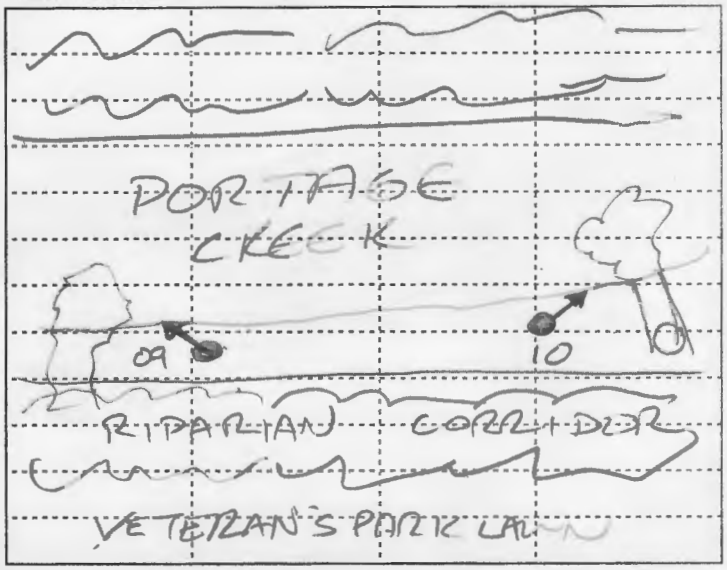
weather:
hot and humid
set up at 20:00

Weather: __/__/____

start time: moon:
end time: Sky:
Wind:

weather:

Site Details



Dominant Vegetation:

1 silver maple 3 _____
2 _____ 4 _____

see leaf collection

09 ANABAT Details: __/__/__

Anabat # 0422 0423	GPS
Battery # 37	lat: 42° 17.700' N
Microphone # 66	long: 085° 34.403' W
Cable # 118	PHOTO DSC 00181
CARD # 100	~~BOX 37~~

Sampling Habitat	Total Calls	Total Species
muddy bank aimed up Portage Creek - sampling below silver maple canopy	0	0

✓10 ANABAT Details: __/__/__

Anabat # 0405 0408	GPS
Battery # 53	lat: 42° 17.712' N
Microphone # 96	long: 085° 34.403' W
Cable # 116	PHOTO DSC 00182
CARD # 059	BOX 28

Sampling Habitat	Total Calls	Total Species
muddy bank aimed down Portage Creek sampling below silver maple canopy	47	4

Sky Code	
0	clear
1	scattered clouds
2	cloudy or overcast
3	fog or drizzle
4	sustained rain

Beauford Wind Scale
0 calm (0 mph)
1 light wind (1-3 mph)
2 light breeze (4-7 mph)
3 gentle breeze (8-12 mph)
4 moderate breeze (13-18 mph)

Starting Date: 19 JULY 2013
Total Sample Nights: 1

Project Name:
Site Name:

Weather: 19 JULY 2013

start time: 18:00 moon: 3/4 +
end time: 08:00 Sky: 1
Wind: 1
weather:
hot and humid - chance of thunderstorms

Weather: __/__/____

start time: moon:
end time: Sky:
Wind:
weather:

Site Details

See DATA SHEET 1 of 9

Dominant Vegetation:

1 _____ 3 _____
2 _____ 4 _____

SITE 01

ANABAT Details: 18 JUL

Anabat # 0424 0427	GPS
Battery # 45	lat: 42°17.857N
Microphone # 95	long: 085°41.089W
Cable # 115	
CARD # 107	~~80x14~~

Sampling Habitat	Total Calls	Total Species
gravel road facing snag 03 and large maple	3	2

ANABAT Details: __/__/____

Anabat #	GPS
Battery #	lat:
Microphone #	long:
Cable #	
CARD #	

Sampling Habitat	Total Calls	Total Species

Sky Code	
0	clear
1	scattered clouds
2	cloudy or overcast
3	fog or drizzle
4	sustained rain

Beauford Wind Scale
0 calm (0 mph)
1 light wind (1-3 mph)
2 light breeze (4-7 mph)
3 gentle breeze (8-12 mph)
4 moderate breeze (13-18 mph)

Starting Date: 19 JULY 2013
Total Sample Nights: 1

Project Name:
Site Name:

Project: Pg 8 of 9

Weather: ___/___/_____

start time: 18:00 moon: 3/4+
end time: 08:00 Sky: 1
Wind: 1

weather:
hot and humid - chance of thunderstorms

Weather: ___/___/_____

start time: moon:
end time: Sky:
Wind:

weather:

Site Details

see DATA SHEET 2 of 9

Dominant Vegetation:

1 _____ 3 _____
2 _____ 4 _____

ANABAT Details: 07/19/13

Anabat # 0418 0419	GPS
Battery # 52	lat: 42°17.642N
Microphone # 44	long: 085°34.401W
Cable # 114	
CARD # 33 — BOX 12	

Sampling Habitat	Total Calls	Total Species
snag OL	46	4

ANABAT Details: ___/___/___

Anabat # 0426 0425	GPS
Battery # 59	lat: 42°17.652N
Microphone # NA03	long: 085°34.401W
Cable # 111	
CARD # 67	BOX 26

Sampling Habitat	Total Calls	Total Species
snag OL	34	4

Sky Code	
0	clear
1	scattered clouds
2	cloudy or overcast
3	fog or drizzle
4	sustained rain

Beauford Wind Scale
0 calm (0 mph)
1 light wind (1-3 mph)
2 light breeze (4-7 mph)
3 gentle breeze (8-12 mph)
4 moderate breeze (13-18 mph)

Starting Date: 19 JULY 2013
Total Sample Nights: 1

Project Name:
Site Name:

Project: Pg 9 of 9

Weather: 19 / JUL / 2013

start time: 1800 moon: 3/4 +
end time: 0840 Sky: 1
Wind: 1
weather:
hot and humid - chance of thunderstorms

Weather: __ / __ / ____

start time: moon:
end time: Sky:
Wind:
weather:

Site Details

See DATA SHEET

6 of 9

Dominant Vegetation:

1 _____ 3 _____
2 _____ 4 _____

ANABAT Details: __ / __ / __

Anabat # 0405 0406	GPS
Battery # 53	lat: 42° 17.700 N
Microphone # 96	long: 085° 34.403 W
Cable # 118	
CARD # 59 ~~87~~ 28	

Sampling Habitat	Total Calls	Total Species
SITE 09	85	4

ANABAT Details: __ / __ / __

Anabat # 0433 0437	GPS
Battery #	lat: 42° 17.712 N
Microphone # 97	long: 085° 34.403 W
Cable # 120	
CARD # 94	

Sampling Habitat	Total Calls	Total Species
SITE 10	50	4

Sky Code	
0	clear
1	scattered clouds
2	cloudy or overcast
3	fog or drizzle
4	sustained rain

Beauford Wind Scale
0 calm (0 mph)
1 light wind (1-3 mph)
2 light breeze (4-7 mph)
3 gentle breeze (8-12 mph)
4 moderate breeze (13-18 mph)

APPENDIX III - Calibration Records

NAME	EXP. NO.	ASSAY

PURPOSE

VESPER ENVIRONMENTAL CALIBRATION NOTES

NOTES

DATE

ANABAT	ZCAIM	MIKE	CARD	FIRM	SLEEP	FILES	
B2335RG NEES 114	CF01460 NEES 200	NEES 98	NEES 69	X	X	463	
B2670RG NEES 190	CF00885 NEES 135	NEES 96	NEES 102	X	X	463	04 MAY 2013
B2332RG NEES 127	CF01011 NEES 134	NEES 68	NEES 85	X	X	463	
B2908RG NEES 195	CF01085 NEES 163	NEES 97	NEES 91	X	X	463	
B1702RG NEES 146	CF01090 NEES 159	NEES 96	NEES 85	X	X	463	
B2673RG NEES 172	CF00882 NEES 110	NAI 03	NEES 102	X	X	463	06 MAY 2013
B2318RG NEES 119	CF01088 NEES 157	NEES 68	NEES 70	X	X	463	
B2671RG NEES 179	CF01282 NEES 186	NEES 68	NEES 34	X	X	3240	
B2447RG NEES 122	CF01491 NEES 198	NAI 03	NEES 35	X	X	3240	
B2444RG NEES 145	CF01014 NEES 138	NEES 97	NEES 104	X	X	3240	08 MAY 2013
B2915RG NEES 196	CF01511 NEES 114	NEES 96	NEES 36	X	X	3240	
B2909RG NEES 400	CF01458 NEES 407	NEES 68	NEES 38	X	X	3240	
B2189RG NEES 405	CF00890 NEES 406	NEES 97	NEES 39	X	X	3240	
B2914RG NEES 412	CF00886 NEES 413	NAI 03	NEES 41	X	X	3240	10 MAY 2013
B2442RG NEES 414	CF01013 NEES 415	NEES 96	NEES 46		X	3240	
B2334RG NEES 416	CF01069 NEES 417	NAI 03	NEES 110	X		3240	
B2331RG NEES 418	CF01012 NEES 419	NEES 68	NEES 47	X		3,240	
B2337RG NEES 420	CF01277 NEES 421	NEES 96	NEES 73	X		2,541	13 MAY 2013
B2916RG NEES 422	CF00880 NEES 423	NEES 97	NEES 80	X		3,240	

SIGNATURE

NAME	EXP. NO.	ASSAY

PURPOSE: PORTAGE CREEK PROJECT, MI

NOTES:

DATE: 15 JULY 2013

ANABAT	ZCAIM	MIKE	CABLE	BOX	ANNOTATION	FILES RECORDED
00416	00417	NEES 95	NEES 110	BOX 29	X	X
00418	00419	NEES 76	NEES 110	BOX 12	X	X
00401	00403	NEES 86	NEES 112	BOX 24	X	X
00426	00425	NAI 03	NEES 113	BOX 26	X	X
00424	00427	NEES 44	NEES 114	BOX 14	X	X
00429	00428	NEES 52	NEES 115	BOX 13	X	X
00405	00406	NEES 97	NEES 116	BOX 28	X	X
00414	00415	NEES 87	NEES 45	BOX 27	X	X
00430	00431	NEES 81	NEES 42	BOX 34	X	X
00433	00432	NEES 28	NEES 54	BOX 25	X	X
00420	00421	NEES 96	NEES 117	BOX 35	X	X
00422	00423	NEES 66	NEES 118	BOX 37	X	X
					X	X
					X	X

MIKE	COLOR	20kHz	30kHz	40kHz	50kHz	60kHz	70kHz	ANGLES
NEES 86	B	82	72	62	59	65	80	X
NEES 81	B	83	72	64	59	68	76	X
NEES 95	G	82	71	59	56	59	71	X
NEES 76	B	85	75	67	59	65	77	X
NAI 03	G	79	69	59	50	59	67	X
NEES 44	G	77	67	56	50	59	65	X
NEES 52	B	85	74	68	59	64	73	X
NEES 97	G	85	69	59	50	59	65	X
NEES 87	B	83	73	64	56	62	69	X
NEES 96	G	81	70	59	50	59	65	X
NEES 28	B	84	74	65	59	65	75	X
NEES 66	G	84	67	59	50	65	70	X
NEES 67	G	84	73	62	50	59	68	X
								X

SIGNATURE

APPENDIX IV - EchoClass Call Analysis Output

APPENDIX FOUR: Acoustic Data Analysis of Portage Creek Monitoring Survey - EchoClass v1.1 File Summary

Sample Site	Sample Date	Total Number of Calls		High		Low		Big Brown Bat		Tri-colored		Unknown	
		Files	Pulses	Files	Pulses	Files	Pulses	Files	Pulses	Files	Pulses	Files	Pulses
Site 01	7/17/2013												
Site 01	7/19/2013	3	8	1	3	2	5					1	2
Site 02	7/17/2013	10	78	3	28	8	50	1	11			6	32
Site 02	7/19/2013	9	41			9	41	1	3			3	7
Site 03	7/17/2013	18	187	2	27	17	160	**6**	**77**			8	54
Site 03	7/19/2013	5	58			5	58	1	19			2	11
Site 04	7/17/2013	8	61	8	28	8	33					4	32
Site 05	7/17/2013	18	186	1	7	17	179	**6**	**97**			6	40
Site 06	7/17/2013	19	299	5	10	17	289	**12**	**282**			4	8
Site 07	7/17/2013	48	458	2	2	48	456	**6**	**140**			17	103
Site 08	7/17/2013	54	1205	16	77	51	1128	**33**	**940**			12	152
Site 09	7/17/2013												
Site 09	7/19/2013	8	56			8	56	**4**	**37**			2	4
Site 10	7/17/2013	42	459	6	21	42	438	**22**	**349**			13	44
Site 10	7/19/2013	24	413	1	1	24	412	**20**	**403**			4	10

Sample Site	Sample Date	Migratory Bats						Myotis bats							
		Silver-Haired		Red Bat		Hoary Bat		Small-footed		Little Brown		Northern		Indiana	
		Files	Pulses	Files	Pulses	Files	Pulses	Files	Pulses	Files	Pulses	Files	Pulses	Files	Pulses
Site 01	7/17/2013														
Site 01	7/19/2013			**2**	**6**										
Site 02	7/17/2013			1	6	1	9			1	20				
Site 02	7/19/2013	1	8	**2**	**15**	2	8								
Site 03	7/17/2013	1	18	2	35	1	3								
Site 03	7/19/2013			**2**	**28**										
Site 04	7/17/2013											**4**	**29**		
Site 05	7/17/2013	3	31	1	7	2	11								
Site 06	7/17/2013			2	6	1	3								
Site 07	7/17/2013	1	4	1	6	**23**	**205**								
Site 08	7/17/2013	2	13	6	86							1	14		
Site 09	7/17/2013														
Site 09	7/19/2013			1	8	1	7								
Site 10	7/17/2013			4	42									**3**	**24**
Site 10	7/19/2013														

represents values <= 0.01 (MLS = 3)
represents values <= 0.05 & > 0.01 (MLS = 2)
represents values <= 0.10 & > 0.05 (MLS = 1)